US008410629B2

(12) United States Patent
Ryu et al.

(10) **Patent No.: US 8,410,629 B2**

(45) **Date of Patent: Apr. 2, 2013**

(54) **TAPERED MAGNETIC THRUST BEARING WITHIN AN ELECTRIC GENERATOR WITH ADJUSTING AIR GAP CONTROLS**

(76) Inventors: **Byung-Sue Ryu**, Seoul (KR); **Young-Sil Yu**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 312 days.

(21) Appl. No.: **12/774,385**

(22) Filed: **May 5, 2010**

(65) **Prior Publication Data**

US 2011/0241348 A1 Oct. 6, 2011

(30) **Foreign Application Priority Data**

Apr. 1, 2010 (KR) 10-2010-0029684

(51) **Int. Cl.**
F03D 9/00 (2006.01)

(52) **U.S. Cl.** **290/55**; 310/90.5

(58) **Field of Classification Search** 310/90.5, 310/156.04

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,360,470 A *	11/1994	Ono et al.	....	104/284
5,894,181 A *	4/1999	Imlach	....	310/90.5
6,707,200 B2 *	3/2004	Carroll et al.	....	310/90.5
6,982,505 B2 *	1/2006	Horng et al.	....	310/51
2006/0012258 A1 *	1/2006	Sun et al.	....	310/90.5
2008/0042504 A1 *	2/2008	Thibodeau et al.	....	310/90.5
2008/0122308 A1 *	5/2008	Mleux	....	310/90.5

FOREIGN PATENT DOCUMENTS

KR	10-0743475	7/2007

* cited by examiner

Primary Examiner — Vanessa Girardi

(74) *Attorney, Agent, or Firm* — Cantor Colburn LLP

(57) **ABSTRACT**

A magnetically balanced electric generator is provided, which includes a rotor rotating, a fixing structure having a fixing axis, a rotating magnet body movably coupled with the fixing axis, and engaged with the rotor, a power-generating block vertically separated from the rotating magnet body, a first magnet mounted along the circumference of the rotating magnet body, a second magnet mounted along the circumference of the power-generating block, power-generating magnets mounted in the rotating magnet body and rotating about the fixing axis upon rotation of the rotating magnet body, power-generating units mounted in the power-generating block to generate electricity because of interaction with the power-generating magnet, and a gap control unit moving the rotating magnet body with an interaction of an external force to control a gap between the rotating magnet body and the power-generating block.

4 Claims, 5 Drawing Sheets

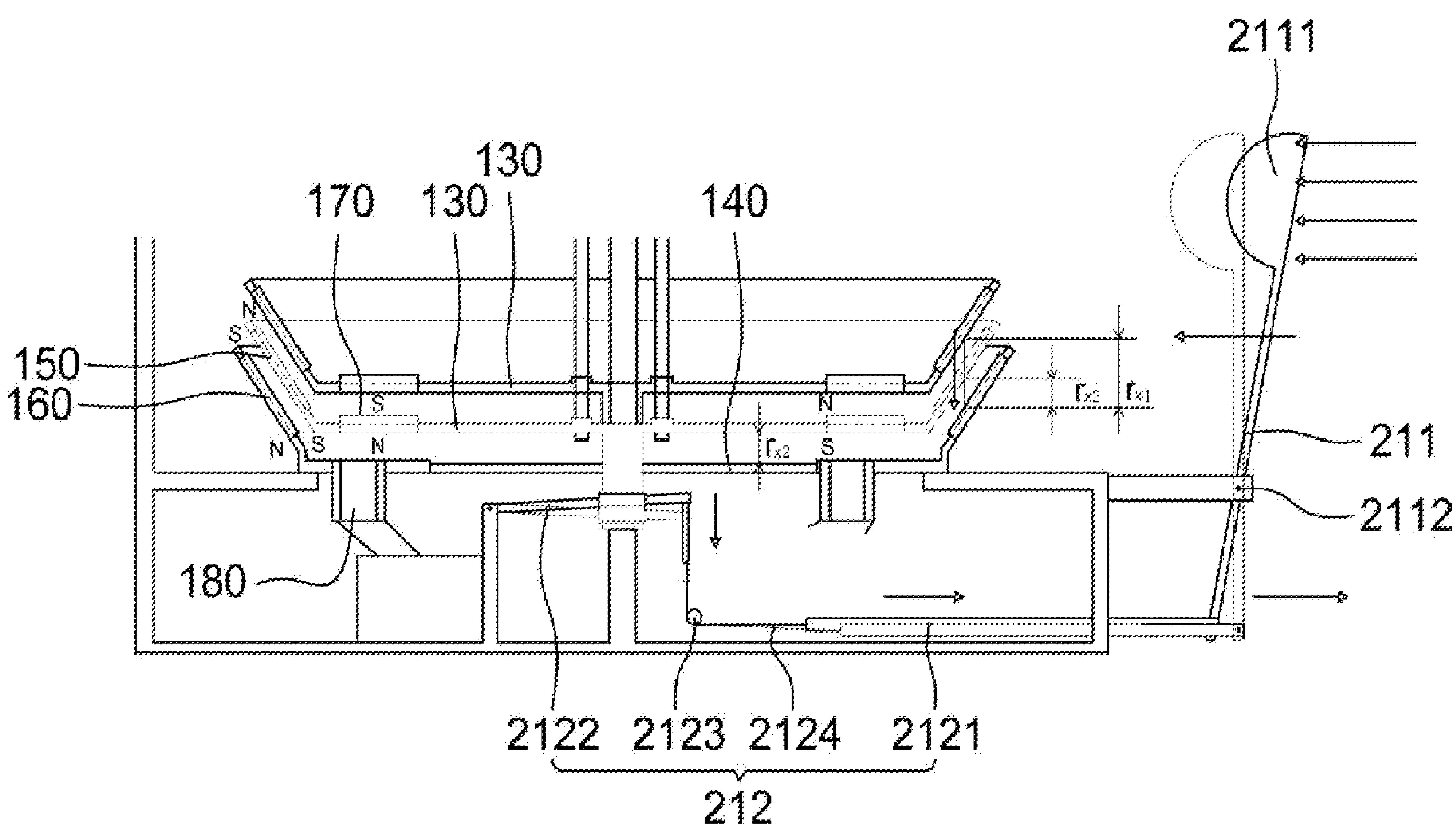


FIG. 1

Prior Art

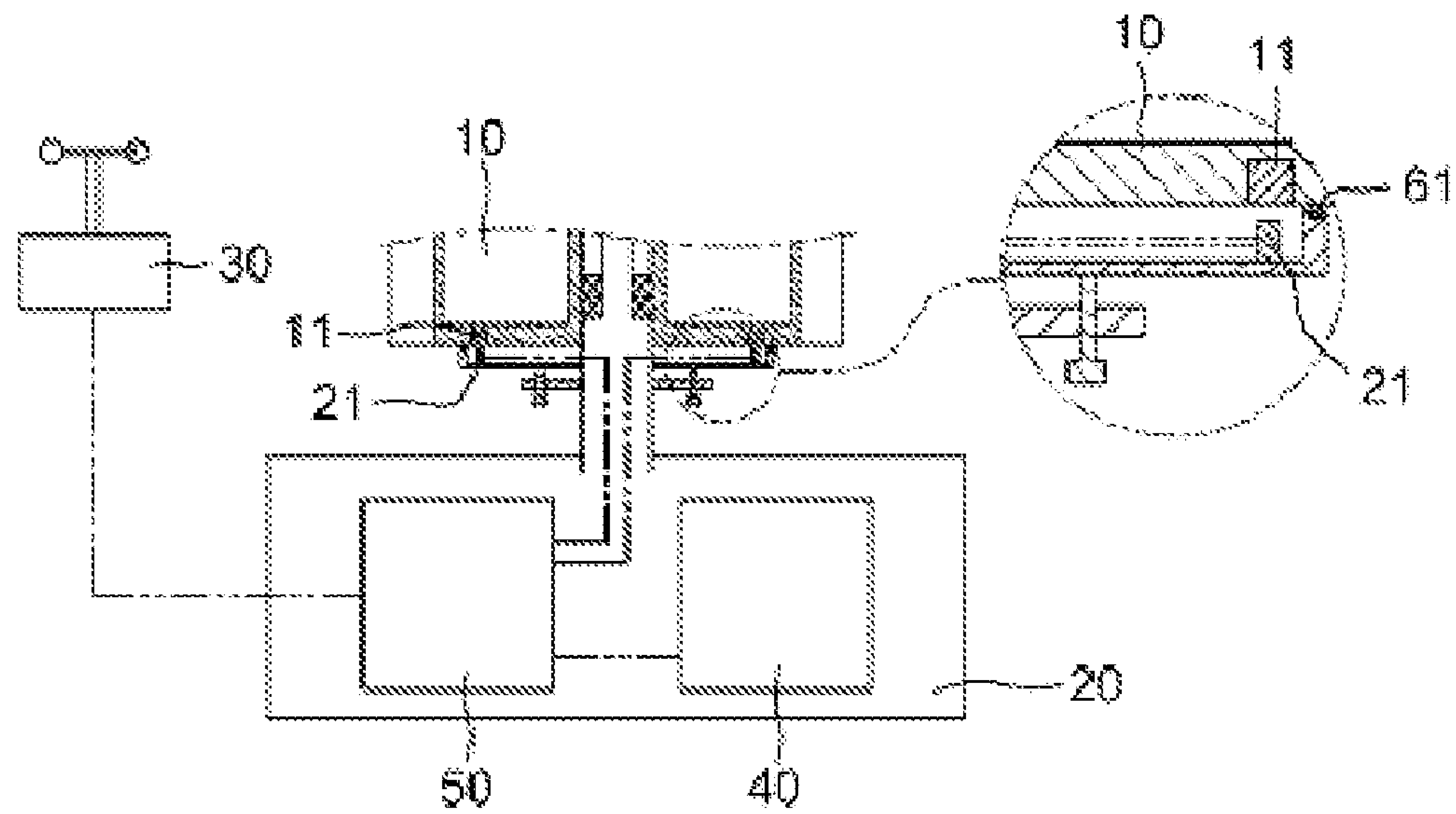


FIG. 2

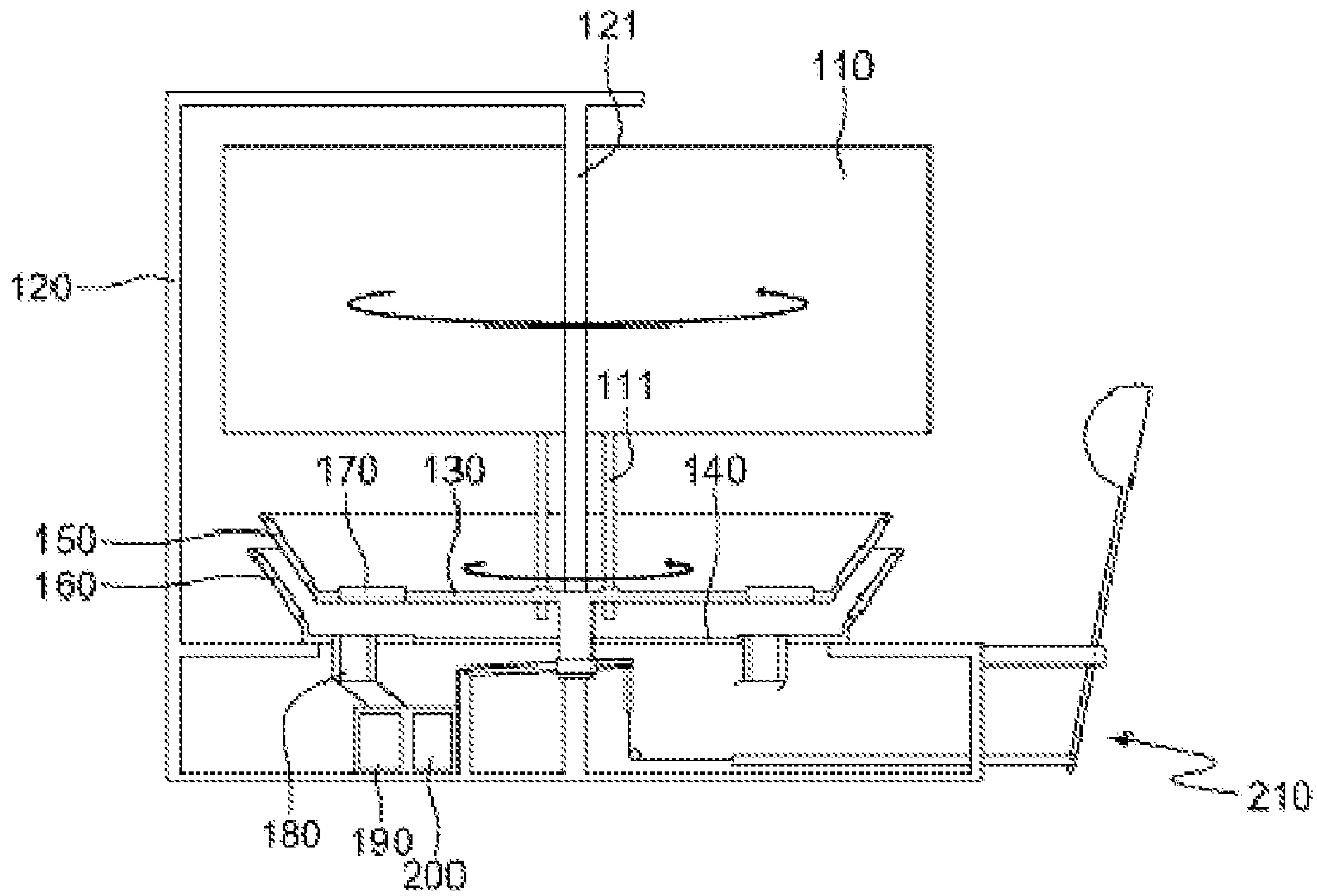


FIG. 3

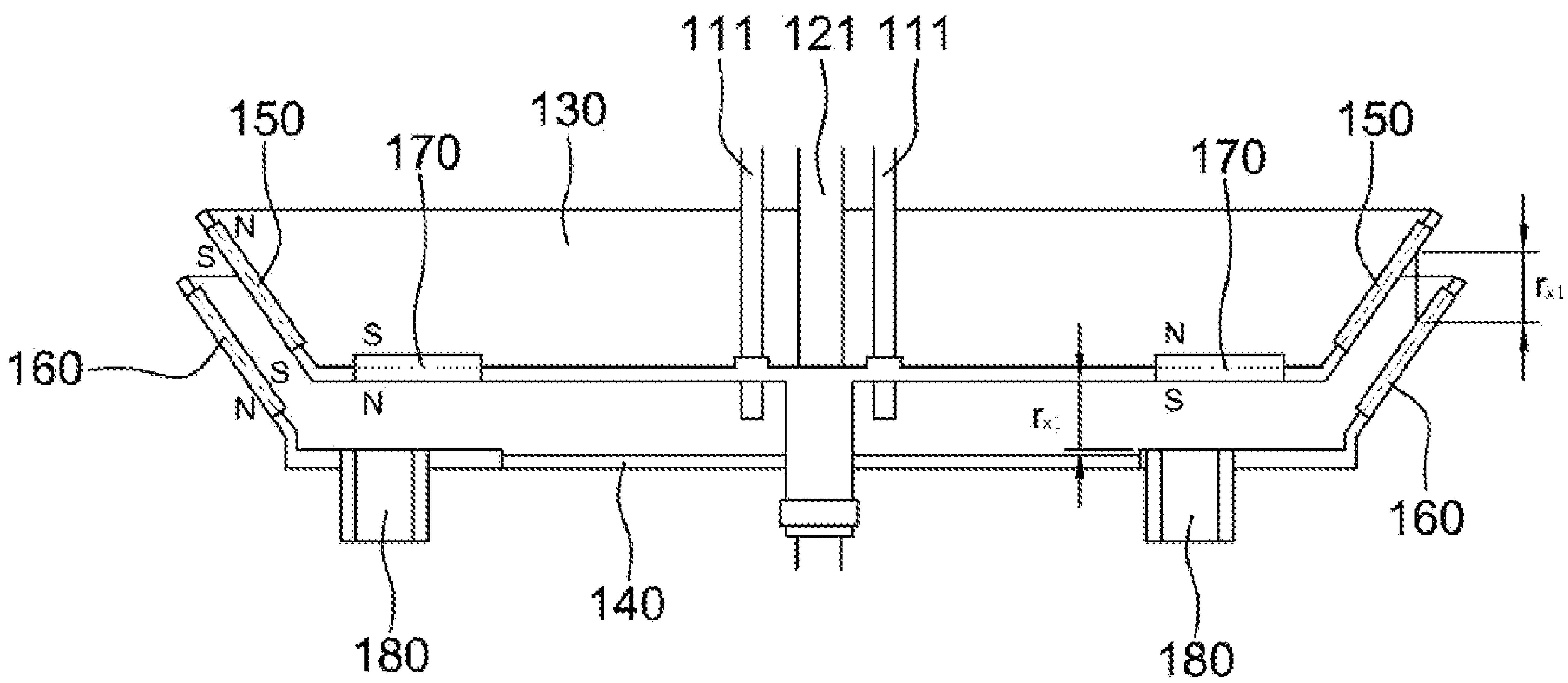

111
121
111
150
130
170
170
150
N
S
S
N
S
N
N
S
160
160
140
180
180

FIG. 4

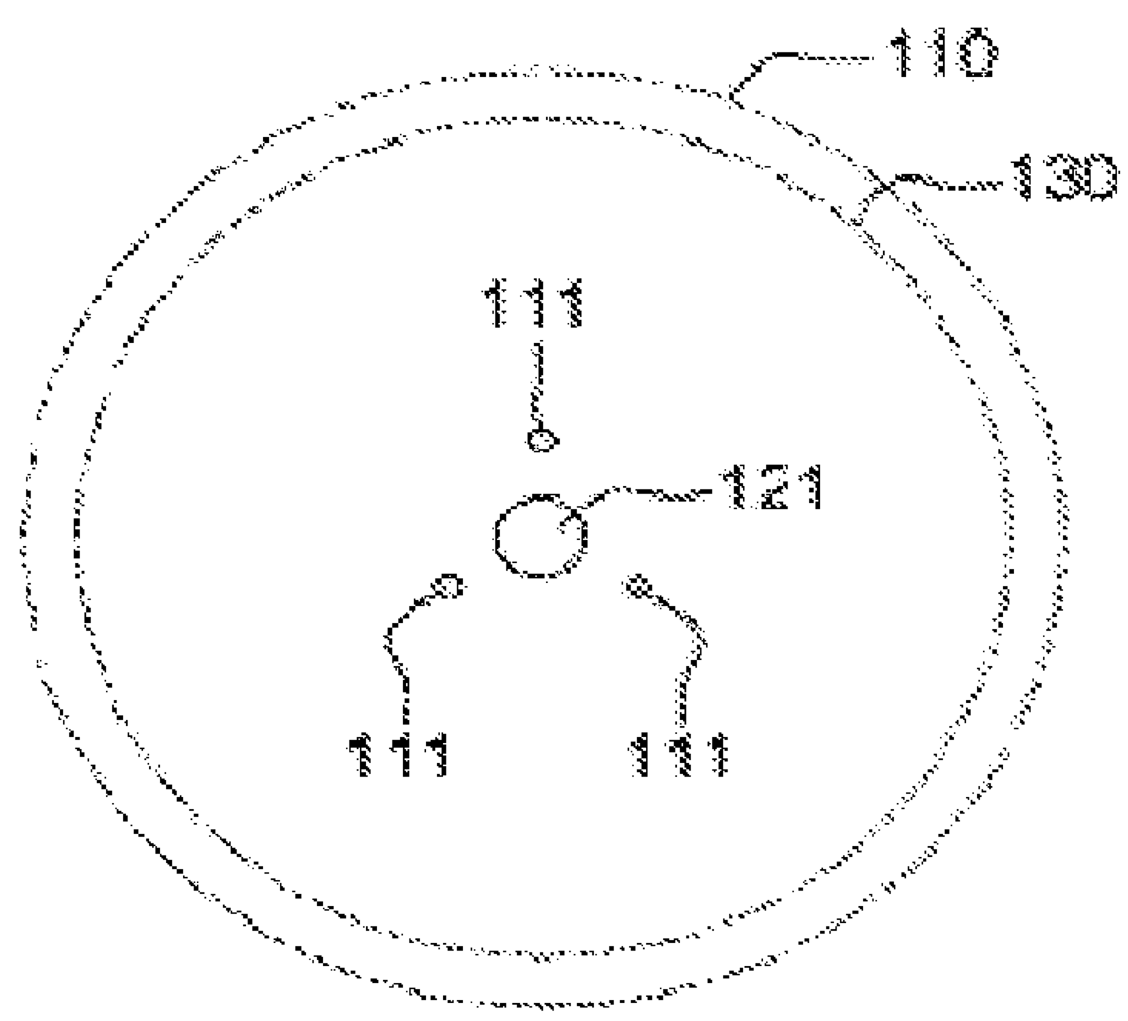

110
130
111
121
111
111

FIG. 5

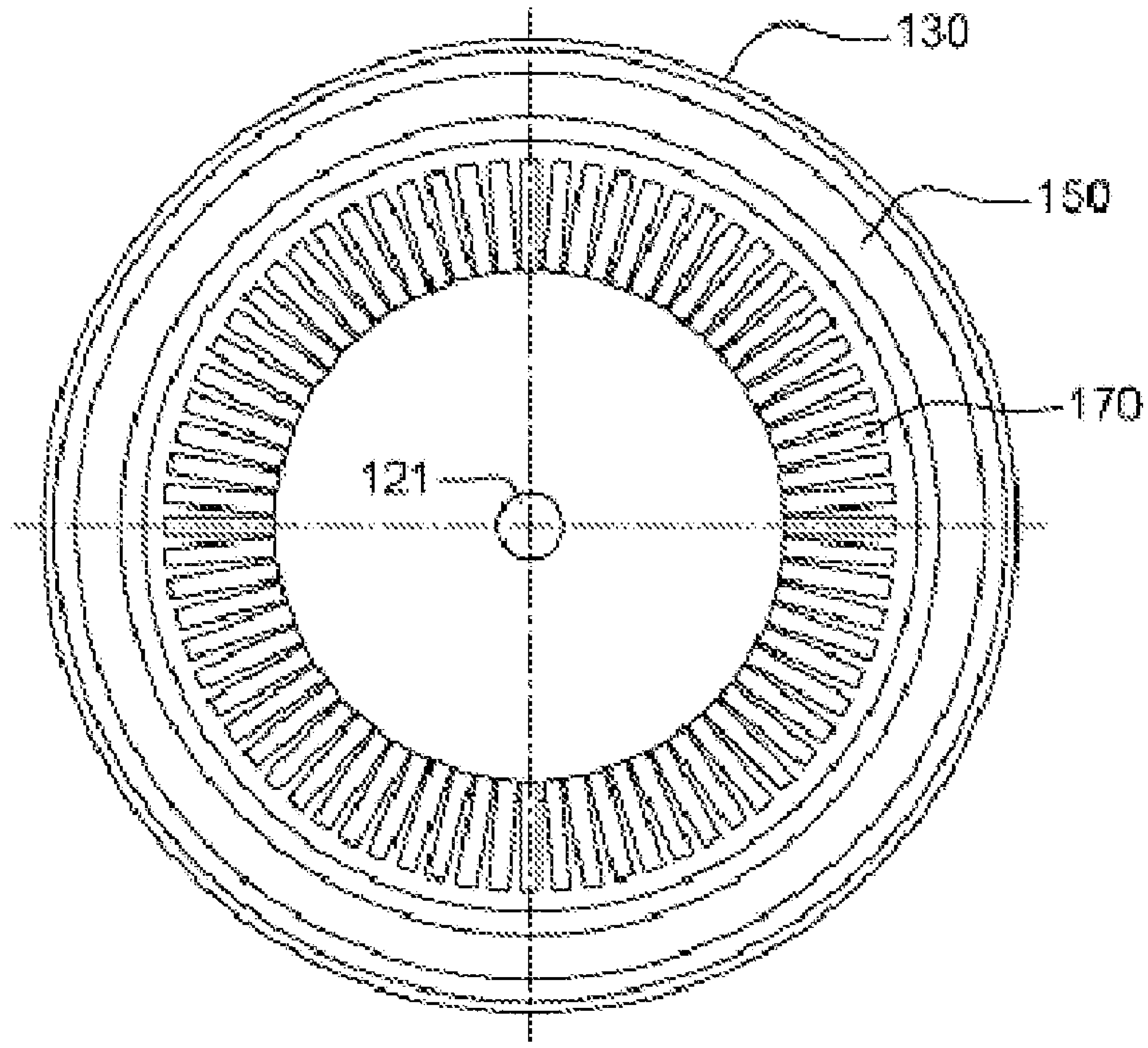


FIG. 6

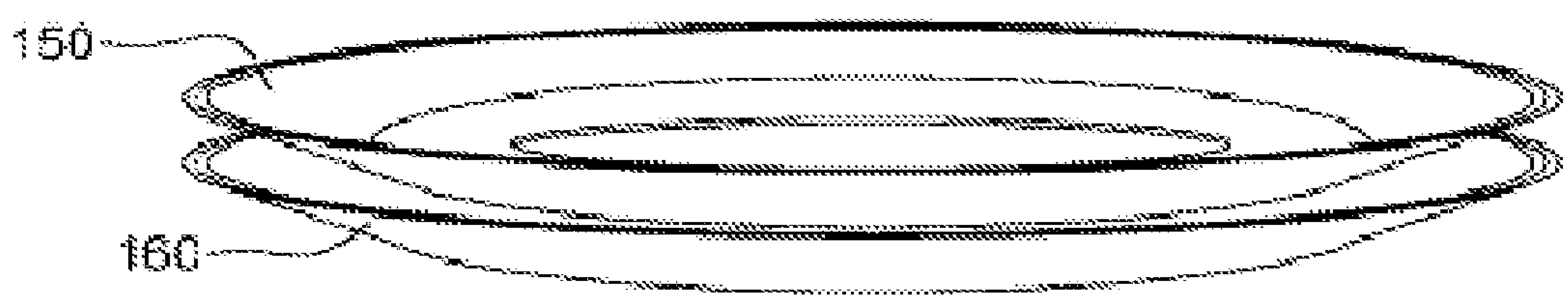


FIG. 7

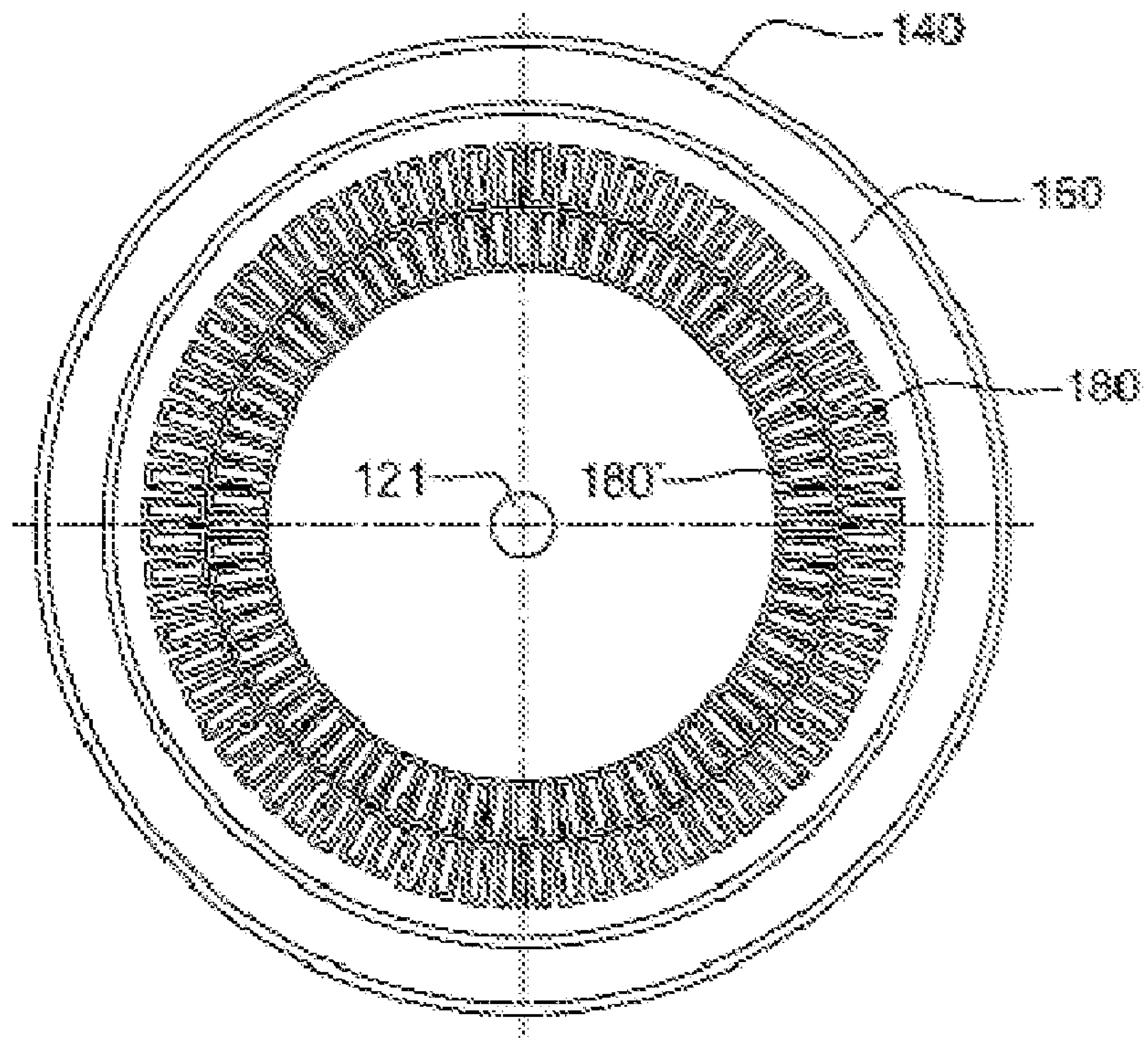


FIG. 8

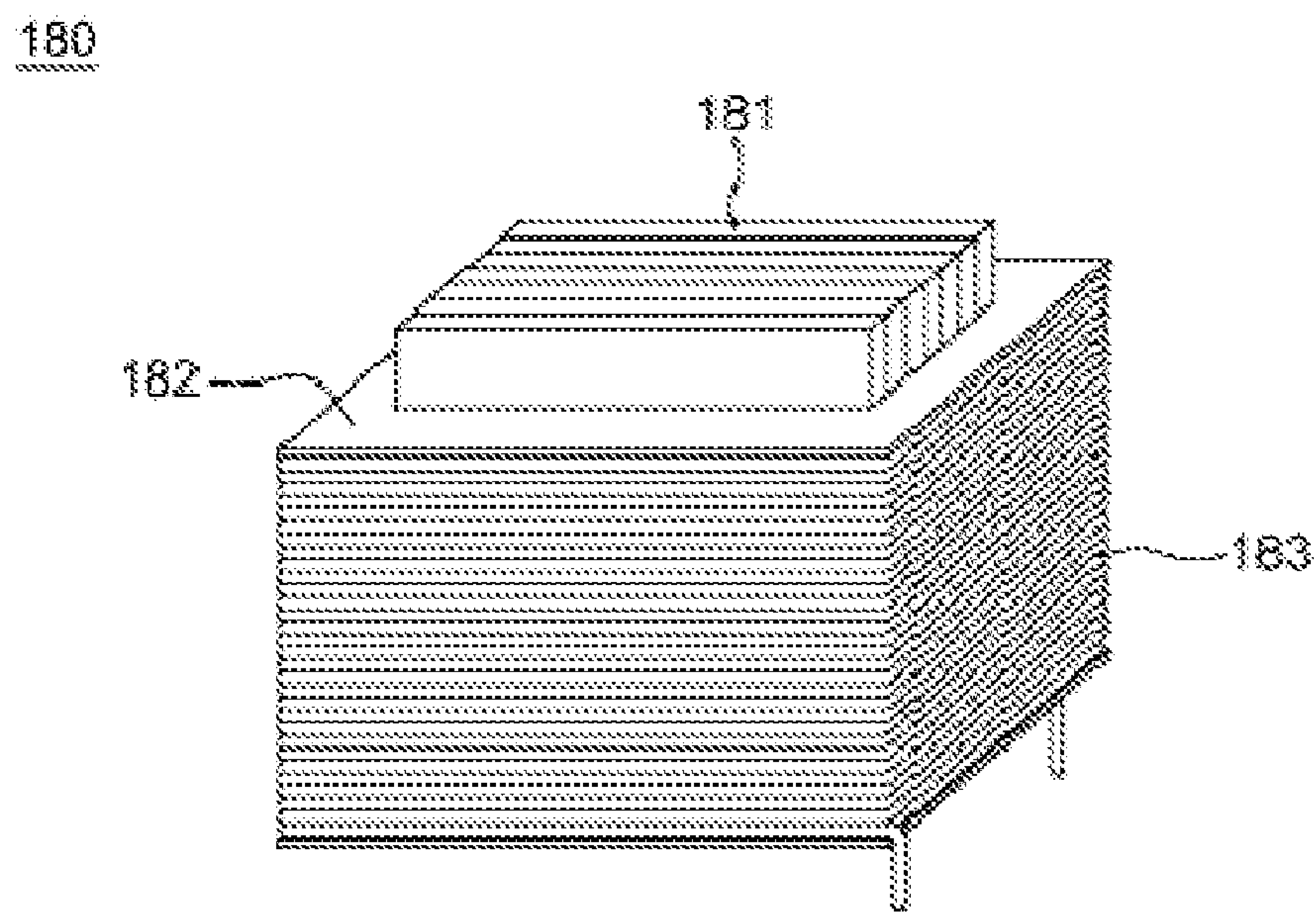
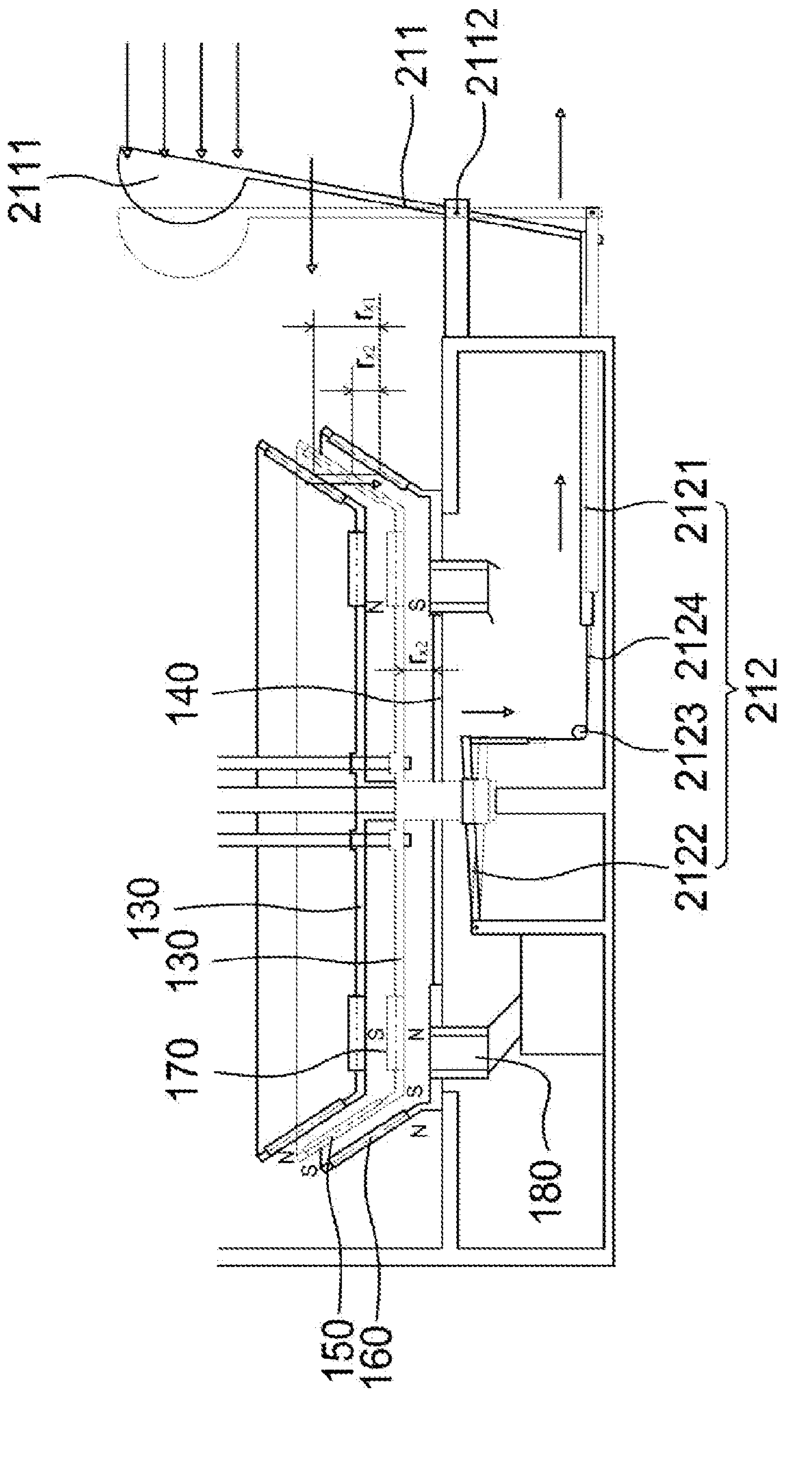


FIG. 9


2111
211
2112
2121
2124
2123
2122
212
140
130
130
170
180
150
160
N
S

TAPERED MAGNETIC THRUST BEARING WITHIN AN ELECTRIC GENERATOR WITH ADJUSTING AIR GAP CONTROLS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates, in general, to an electric generator using a permanent magnet in a shape of a tapered cone, especially, one which induces a useful equilibrium of magnetic force and, more particularly, to a magnetically balanced electric generator, in which a power-generating core unit and a power-generating magnet are spaced apart at constant intervals using a magnetically repulsive force, which is caused by a permanent magnet shaped like a tapered cone, and a magnetically attractive force, which is caused between the power-generating core unit and a power-generating magnet, and the interval is controlled depending on the intensity of wind, thereby improving power-generation efficiency, the lifetime of parts, and economical efficiency of products.

2. Description of the Related Art

Generally, an electric generator means a device that includes a rotor which rotates under external force, a fixing structure supporting the rotor, and an electricity-generating unit which operates upon rotation of the rotor. However, bearings of such electric generators have a problem in that a certain amount of oil should be regularly supplied to the bearings and the contamination of foreign substances causes damage to the bearings.

Further, in case of wind turbines using wind power as an external force, an electrical-connection controller should be installed in order to generate electricity as expressed by the formula $E=C_p\times(1/2)\times\rho\times A\times v^3$, which however is difficult work, and thus problems such as the complexity of parts, burning-out of electric parts or the like occur. Wind turbines are the hardest kinds of electric generators to design because they have to deal with energy proportional to cubic wind velocity.

Meanwhile, the applicant developed a new construction electric generator in consideration of the fact that existing vertical type wind generators do not sufficiently utilize wind power, which generator was disclosed in Korean Patent Registration No. 0743475.

FIG. **1** shows the structure of the electric generator in a cross-sectional view.

The disclosed electric generator is called a variable electric generator for a wind turbine, which includes a group **11** of magnets which is installed on a lower end of a rotor **10** rotating with the wind, a plurality of core units **21** which is installed in a fixing structure in such a manner as to be arranged concentrically with the magnets of the group and which upon rotation of the rotor **10** interacts with the magnets to thereby generate electricity, an anemometer **30** detecting the magnitude of wind velocity, an electric accumulator **40** storing electricity generated by the core unit **21**, and a terminal **50** connecting the respective core units **21** and the electric accumulator together such that the core units are selectively connected with the electric accumulator according to the wind velocity detected by the anemometer **30**.

The variable electric generator of this type changes a power-generating condition depending on the intensity of wind, having such advantages as more efficiently utilizing wind power.

In the meantime, in order to generate electricity using interaction between the power-generating magnet and the core unit, in which a coil is wound around a silicon steel plate, an interval between the power-generating magnet and the core unit should be maintained to approximately 1 mm. Then, since the interval is maintained by a spherical steel bearing **61**, which is mounted between the rotor and the fixing structure, the bearing should be periodically lubricated so that the interval can be maintained accurately and efficiently, which is troublesome work, otherwise the bearing may burn out during use, problematically requiring replacement with new one.

Furthermore, problems such as contact points burning out during manipulation of the power-generating coil, which may result in a reduction in lifetime, may occur.

SUMMARY OF THE INVENTION

Accordingly, the present invention has been made keeping in mind the above problems occurring in the related art, and the present invention intends to propose a magnetically balanced electric generator in which a rotating magnet body is separated at a constant interval from a power-generating block, thereby maintaining a magnetically balanced interval between a power-generating core unit and a power-generating magnet, without providing a separate spherical steel bearing, using a magnetically repulsive force between two magnets each having the shape of a tapered cone, and a magnetically attractive force occurring between the power-generating magnet and the power-generating core unit, thereby solving problems such as replacement or the like of a bearing being a nuisance and accompanied by cost increases.

Another object of the present invention is to provide a magnetically balanced electric generator in which an interval between a power-generating core unit and a power-generating magnet is controlled according to the intensity of wind, thereby considerably improving the efficiency of power generation.

In order to achieve the above objects, according to one aspect of the present invention, there is provided a magnetically balanced electric generator including: a rotor rotating with external force; a fixing structure having a fixing axis rotatably supporting the rotor; a rotating magnet body coupled with the fixing axis in such a manner as to be movable therealong, and engaged with the rotor so as to rotate together with the rotor; a power-generating block installed on the fixing structure while being vertically separated from a lower portion of the rotating magnet body; a first magnet mounted along the circumference of the rotating magnet body; a second magnet mounted along the circumference of the power-generating block and generating a repulsive force while repelling the first magnet, thereby magnetically separating the rotating magnet body from the power-generating block; a plurality of power-generating magnets mounted in the rotating magnet body and rotating about the fixing axis upon rotation of the rotating magnet body; a plurality of power-generating units mounted in the power-generating block such that they are positioned vertically downwards with respect to the power-generating magnet, and generating electricity because of the interaction with the power-generating magnet upon rotation of the power-generating magnet; and a gap control unit moving the rotating magnet body because of the interaction with an external force so as to control a gap between the rotating magnet body and the power-generating block and therefore control a gap between the power-generating magnets and the power-generating core units, variably changing the amount of power generation.

In an exemplary embodiment, the gap control unit may include a reaction lever hinge-coupled to the fixing structure and rotating about a hinge axis when under external force; and a connector, upon rotation of the reaction lever, connecting the reaction lever and the rotating magnet body so as to pull down the rotating magnet body.

In an exemplary embodiment, the first and second magnets may have a tapered cone shape, the upper portion of which is wider than the lower portion.

In an exemplary embodiment, the external force may be wind power which rotates the rotor so that electricity is generated with interaction between the power-generating core units and the power-generating magnets.

According to the construction of the present invention, the rotating magnet body rotates together with the rotor while being maintained at a constant interval from the upper portion of the power-generating block because of the repulsive force between the two tapered conical magnets and the attractive force occurring between the power-generating core units and the power-generating magnets, thereby providing convenience of maintenance and reducing energy loss by resistance because a separate bearing is not used.

Further, as external force applied to the rotor increases, the power-generating magnets and the power-generating core units become proximal to each other, whereas on the other hand as external force applied to the rotor decreases, for example the wind blows comparatively lightly, the power-generating magnets are allowed to be spaced far away from the power-generating core units. That is, in the correlated equation $F=k\times(m_1\times m_2)/r^2$, if an interval decreases, F and the amount of power generation will increase proportional to $1/r^2$, and if an interval increases, the amount of power generation will decrease proportional to $1/r^2$, thereby providing efficient power generation in conformity with wind velocity.

That is, referring to the correlated equation $E=C_p\times(\frac{1}{2})\times\rho\times A\times v^3$, there is an implementation in which a power generator suitable for a 3-dimension v^3, a device that corresponds to the 3-dimensions of $(1/r)^2\times v_c$, is realized. Here, E indicates power-generation energy, C_p indicates the efficiency, ρ indicates air density, A indicates the cross section that is subject to wind, v indicates the wind velocity, v_c indicates relative velocity of a power-generating magnet to the power-generating core unit according to the wind velocity, and r indicates a distance between the power-generating core unit and the power-generating magnet.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will be more clearly understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a cross-sectional view illustrative of the structure of a conventional variable electric generator;

FIG. **2** is a front view illustrative of the structure of a magnetically balanced electric generator according to a preferred embodiment of the present invention;

FIG. **3** is a front view illustrative of the major structure of the electric generator of FIG. **2**;

FIG. **4** is a plan view illustrative of the coupling structure between a rotor and a rotating magnet body according to an embodiment of the present invention;

FIG. **5** is a plan view illustrative of the rotating magnet body;

FIG. **6** is a perspective view illustrative of first and second magnets according to an embodiment of the present invention;

FIG. **7** is a plan view illustrative of a power-generating block according to an embodiment of the present invention;

FIG. **8** is a perspective view illustrative of a power-generating core unit according to an embodiment of the present invention; and

FIG. **9** is a front view illustrative of the structure of a gap control unit according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in greater detail to a preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings. Wherever possible, the same reference numerals will be used throughout the drawings and the description to refer to the same or like parts.

FIG. **2** is a front view illustrative of the structure of a magnetically balanced electric generator according to a preferred embodiment of the present invention, FIG. **3** is a front view illustrative of the major structure of the electric generator of FIG. **2**, FIG. **4** is a plan view illustrative of the coupling structure between a rotor and a rotating magnet body according to an embodiment of the present invention, FIG. **5** is a plan view illustrative of the rotating magnet body, FIG. **6** is a perspective view illustrative of first and second magnets according to an embodiment of the present invention, FIG. **7** is a plan view illustrative of a power-generating block according to an embodiment of the present invention, and FIG. **8** is a perspective view illustrative of a power-generating core unit according to an embodiment of the present invention.

The magnetically balanced electric generator of the present invention includes a rotor **110**, a fixing structure **120**, a rotating magnet body **130**, a power-generating block **140**, a first magnet **150**, a second magnet **160**, power-generating magnets **170**, and power-generating core units **180**.

The rotor **110** rotates under external force, which may include wind power, water power, vapor pressure, process pressure (e.g. brake pressure) which is produced during the operation of devices, wherein the magnetically balanced electric generator of this embodiment has a structure optimally suitable for wind power.

The fixing structure **120** rotatably supports the rotor **110** and has a vertical fixing axis **121**.

The rotating magnet body **130** is coupled with the fixing axis **121** such that it is movable along the fixing axis **121**. It is also engaged with the rotor **110** by means of an engaging rod **111** body so as to rotate together with the rotor **110**.

Meanwhile, the engaging rod body **111** consists of a plurality of rods, which is arranged in a circular form about the fixing axis **121** and extends from the undersurface of the rotor **110** over the rotating magnet body **130**. Such a structure of an engaging rod body **111** allows the rotating magnet body **130**, which is coupled with the rotor **110** via the engaging rod body **111**, to rotate about the fixing axis **121** upon rotation of the rotor **110**, and it also allows the rotating magnet body **130** to move freely in a vertical direction, provided that the rotating magnet body **130** is requested to be moved by the repulsive force occurring between the first and second magnets **150** and **160**, the attractive force occurring between the power-generating magnets **170** and the power-generating core units **180**, or the action of the gap control unit **210**, which will be described later.

The power-generating block **140** is mounted on the fixing structure **120** in such a manner as to be vertically spaced from a lower portion of the rotating magnet body, so as to provide space for mounting the power-generating core units **180**.

The first magnet **150** is mounted in the rotating magnet body **130** and reacts with the second magnet **160** to thereby produce a repulsive force which keeps the rotating magnet body **130** separated away from the power-generating block **140**. The first magnet **150** has the structure of a circular ring, preferably having the shape of a tapered cone, like a horn, the upper portion of which is wider than the lower portion, the circular ring extending along the circumference of the rotating magnet body **130**.

The second magnet **160** is mounted in the power-generating block **140** and reacts with the first magnet **150** to thereby produce the repulsive force. The second magnet **160** also has the structure of a circular ring, preferably having the shape of a tapered cone, like a horn, the upper portion of which is wider than the lower portion, the circular ring extending along the circumference of the power-generating block **140**.

Being made for the first and second magnets **150** and **160** into tapered cones naturally prevents the rotating magnet body **130**, which is magnetically separated from the power-generating block **140** by the repulsive force, from deviating laterally, thereby relieving the load to be applied to the fixing axis **121** or the engaging rod body **111**.

Meanwhile, the first and second magnets **150** and **160** are arranged so as to face each other at the same polarities, in order to produce the repulsive force. In FIG. **3**, the arrangement is shown in which S polarities of the first and second magnets **150** and **160** face each other.

The power-generating magnet **170** consists of a plurality of magnets **170**, which is arranged in a circular form about the fixing axis **121** in the rotating magnet body **130** such that upon rotation of the rotor **110**, the magnets **170** also rotate about the fixing axis **121**. Here, the magnets **170** are arranged such that adjacent magnets in alternation have opposite polarities for AC power generation. For example, in the case of a magnet **170** having N polarity at its lower side, the opposite magnets **170** adjacent to the former magnet are arranged to have S polarities on the lower sides.

The power-generating core unit **180** consists of a plurality of core units, which is arranged in a circular form about the fixing axis **121** in the power-generating block **140**. Each core unit **180** is provided with a coil **183** which is wound around a core **182** having therein a plurality of silicon steel plates **181**. The core units are arranged vertically downwards from the power-generating magnets **170** so that upon rotation of the rotating magnet body **130**, N and S polarities of the magnets **170** in alternation pass over the upper portion of the core units **180** so as to generate alternating magnetic flux, which causes the coil of the core unit **180** to be voltage-induced, thereby generating the electricity.

The power-generating core units **180** are connected with an electric accumulator **200** via a voltage controller **190** so as to convert the generated electricity to direct current electricity and store it in the electric accumulator. The voltage controller **190** converts irregular voltage, which is generated from the plurality of core units **180**, into constant voltage, and transfers it to the electric accumulator **200**.

In the power generation process of the power-generating magnets **170** and the power-generating core units **180**, an attractive force is generated between the magnets **170** and the core units **180**. This attractive force and the repulsive force, which occurs between the first and second magnets **150** and **160**, become balanced to thereby provide a magnetically balanced equilibrium state, which allows the rotating magnet body **130** to stably rotate while maintaining a constant distance with the power-generating block **140**, even without using a bearing.

Generally, magnetic intensity between two magnets is obtained using Coulomb's law, which can be generally expressed by the following equation 1:

$$H=k\times(m_1\times m_2)/r^2 \quad \text{Equation 1}$$

Meanwhile, the repulsive force between the first and second magnets can be expressed by the following equation 2, using equation 1.

$$H_r=k\times(m_{r1}\times m_{r2})/r_r^2 \quad \text{Equation 2}$$

(here, m_{r1} and m_{r2} are the intensity of the first and second magnets, and r_r is an interval between the first and second magnets)

Meanwhile, the attractive force between the power-generating magnets and power-generating core units can be expressed by the following equation 3, using equation 1.

$$H_a=k\times(m_{a1}\times m_{a2})/r_a^2 \quad \text{Equation 3}$$

(here, m_{a1} and m_{a2} are the intensity of the power-generating magnets and magnetized power-generating core units, and r_a is an interval between the power-generating magnets and the power-generating core units)

If $r_r<r_a$ when $m_{r1}=m_{r2}<m_{a1}=m_{a2}$, the rotating magnet body **130** becomes magnetically balanced at a certain position on the power-generating block **140**, maintaining a stable state.

In order to satisfy the above condition, the present invention is configured such that the power-generating magnets **170** have a magnetic intensity greater than those of the first and second magnets **150** and **160**, and the interval r_a between the power-generating magnets **170** and the power-generating core units **180** is greater than the interval r_r between the first and second magnets.

In case of the first and second magnets **150** and **160**, the power-generating magnets **170**, and the power-generating core units **180** being arranged as such, when the rotating magnet body **130**, which is magnetically separated because of the repulsive force between the first and second magnets, is ready to move away from the power-generating block **140**, at a certain position, the attractive force between the power-generating magnets **170** and the power-generating core units **180** becomes greater than the repulsive force, so that the rotating magnet body **130** does not move away any more and keeps a stable state, which is called in the present invention a magnetically balanced equilibrium state.

Meanwhile, assuming that m_{r1}, m_{r2}, m_{a1}, m_{a2}, r_r, and r^a satisfy the above condition and the respective values are as shown in table 1, the repulsive force and the attractive force according to a change in an interval between the rotating magnet body and the power-generating block change as follows:

TABLE 1

m_{r1}	m_{r2}	r_r	m_{a1}	m_{a2}	r_a	Repulsive Force	Attractive Force
2	2	0.5	3	3	1	16	9
2	2	1	3	3	1.5	4	4
2	2	1.5	3	3	2	1.778	2.25
2	2	2	3	3	2.5	1	1.44
2	2	2.5	3	3	3	0.64	1

Table 1 is a simple comparison of values provided only for illustrative purposes, so that the unit for the assumed values is omitted, and in the calculation of the repulsive force and attractive forces, k of equations 2 and 3 is considered to be 1 because it is a constant.

It can be seen in the table that as the rotating magnet body **130** and the power-generating block **140**, i.e. two magnets, become closer, the repulsive force prevails over the attractive force, so that the rotating magnet body **130** cannot completely come into contact with the power-generating block, but is separated therefrom by means of repulsive force; as the repulsive force and the attractive force become identical to each other at a magnetically balanced equilibrium position, the rotating magnet body **130** maintains a stable state; and as the rotating magnet body **130** moves far away from the power-generating block **140**, the attractive force prevails over the repulsive force, thereby preventing the rotating magnet body **130** from moving farther away.

Meanwhile, the first and second magnets **150** and **160**, which produce the repulsive force, are the structures that extend along the circumferences of the rotating magnet body **130** and the power-generating block **140**. Although the first and second magnets continuously produce repulsive force upon rotation of the rotating magnet body **130**, the rotating magnet body **130** may vibrate due to a discontinuous attractive force because the power-generating magnet **170** and the power-generating core unit **180**, which will produce the attractive force, consist of multiplicity.

Then, according to the present invention, the power-generating core units **180** are arranged in two-row structure in the power-generating block **140**. Here, the two-row structure means that a first row of power-generating core units **180** is arranged about the fixing axis **121** in a circular form in the power-generating block **140**, and a second row of power-generating core units **180'** is further arranged in the circular first row of the core units **180**. Here, all of the inner row of core units **180'** and the outer row of core units **180** are arranged vertically downwards from the power-generating magnet **170**.

Meanwhile, a gap control unit **210** is preferably provided in order to control the amount of power generation through regulating a gap between the rotating magnet body **130** and the power-generating block **140** depending on an external force applied to the rotor **110**.

FIG. **9** is a front view illustrative of the structure of the gap control unit according to an embodiment of the present invention.

In case of the power-generating core units **180**, which interacts with the power-generating magnets **170** to produce electricity, as they approach the power-generating magnets **170**, they produce a greater amount of electricity, and vice versa. Then, when a strong external force is applied to the rotor **110**, the gap control unit **210** lowers the rotating magnet body **130** such that the power-generating magnets **170** and the power-generating core units **180** become closer to each other, whereas, when a weak external force is applied to the rotor **110**, the gap control unit **210** is operated such that the power-generating magnets **170** and the power-generating core units **180** are separated away by means of a repulsive force, thereby performing power generation depending on the magnitude of the wind velocity.

The gap control unit **210** consists of a reaction lever **211** and a connector **212**.

The reaction lever **211** is hinge-coupled at its middle portion to the fixing structure **120** such that it rotates about a hinge axis **2112**. The reaction lever has opposite ends, wherein one end is provided with a pocket **2111** for reception of external force, and the other end is connected with the rotating magnet body **130** via the connector **212**.

When the reaction lever **211** interacts with external force and rotates, the connector **212** draws and lowers the rotating magnet body **130** so as to regulate the interval between the rotating magnet body **130** and the power-generating block **140**. The connector includes a connecting rod **2121** extending from the other end towards inside of the fixing structure **120**, a control rod **2122**, an end of which is rotatably hinge-coupled to the fixing structure while being engaged with the rotating magnet body **130**, and a connecting rope **2124** connecting the control rod **2122** and the connecting rod **2121** via a roller **2123** provided in the fixing structure **120**.

When the reaction lever **211** rotates with external force, the connector **212** draws the rope **2124** via the connecting rod **2121** and the control rod **2122** rotates and draws the rotating magnet body **130**, thereby lowering the rotating magnet body **130**.

Thus, if the external force is wind power, as it increases, an angle increase, at which the reaction lever **211** rotates about the hinge axis **2112**, and accordingly a distance also increases, for which the rotating magnet body **130** moves down. Thus, since the interval r between the power-generating magnet and the power-generating core unit decreases, 1/r increases so that the amount of generated electricity can be increased proportional to wind power.

That is, referring to the correlated equation $E=C_{p}\times(\frac{1}{2})\times\rho\times A\times v^3$, there is an implementation in which, for the power generator suitable for a 3-dimension v^3, a device that corresponds to 3-dimension of $(1/r)^2\times v_c$ is realized. Here, E indicates power-generation energy, C_p indicates the efficiency, ρ indicates air density, A indicates a cross section that is subject to wind, v indicates the wind velocity, v_c indicates relative velocity of the power-generating magnet to the power-generating core unit according to the wind velocity, and r indicates a distance between the power-generating core unit and the power-generating magnet.

On the contrary, if the wind power becomes weakened, the rotating magnet body **130** moves up by means of repulsive force occurring between the first and second magnets **150** and **160**, and at the magnetically balanced position where the repulsive force and the attractive force become balanced, i.e. reach a equilibrium state, the rotating magnet body rotates again while maintaining a stable state.

Although a preferred embodiment of the present invention has been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

What is claimed is:

1. A magnetically balanced electric generator comprising:
- a rotor rotating under external force;
- a fixing structure having a fixing axis rotatably supporting the rotor;
- a rotating magnet body coupled with the fixing axis in such a manner as to be movable therealong, and engaged with the rotor so as to rotate together with the rotor;
- a power-generating block installed on the fixing structure while being vertically separated from a lower portion of the rotating magnet body;
- a first magnet mounted along the circumference of the rotating magnet body;
- a second magnet mounted along the circumference of the power-generating block and generating a repulsive force while repelling the first magnet, thereby magnetically separating the rotating magnet body from the power-generating block;
- a plurality of power-generating magnets mounted in the rotating magnet body and rotating about the fixing axis upon rotation of the rotating magnet body;
- a plurality of power-generating units mounted in the power-generating block such that they are positioned vertically downwards with respect to the power-generating magnet, and generating electricity because of interaction with the power-generating magnet upon rotation of the power-generating magnet; and
- a gap control unit moving the rotating magnet body with an interaction of an external force so as to control a gap between the rotating magnet body and the power-generating block and therefore a gap between the power-generating magnets and the power-generating core units, variably changing the amount of power generation.

2. The magnetically balanced electric generator according to claim **1**, wherein the gap control unit includes a reaction lever hinge-coupled to the fixing structure and rotating about a hinge axis with external force; and, a connector, which upon rotation of the reaction lever, connects the reaction lever and the rotating magnet body so as to pull the rotating magnet body down.

3. The magnetically balanced electric generator according to claim **1**, wherein the first and second magnets have a shape of a tapered cone, the upper portion of which is wider than the lower portion.

4. The magnetically balanced electric generator according to claim **1**, wherein the external force is wind power.

* * * * *